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SCHOOL OF
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MASTER

ACTUARIAL SCIENCE

MASTER´S FINAL WORK

INTERNSHIP REPORT

ACTUARIAL GAINS AND LOSSES FOR AN IRISH PENSION SCHEME

STEPHANIE LUCIC ARENAS

OCTOBER - 2018

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SUPERVISORS:

GORETE PEREIRA

ONOFRE ALVES SIMÕES

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Abstract

Pension plans provide most of income at retirement to many people. They are extremely important as one of the main sources of labor benefits and also of national savings. The liabilities of a pension plan correspond to amounts of money that have to be set aside, in order to pay for future obligations.

The main concern of an actuary performing an actuarial valuation on a pension scheme is whether the estimated liabilities will be enough to cover future commitments. In order to measure and assess if the actuarial valuation is on the safe side, the actuary needs to perform an actuarial gain and loss analysis.

A 5-month internship was done in Mercer, a consulting firm operating in the areas of human capital, wealth and health programs. This paper is the result of the internship. In this report, we aimed to study the basis on how to perform an actuarial valuation, followed by an analysis of the reasoning behind each element that contributes to an actuarial gain or loss. All actions were developed in the framework of the Irish case.

Keywords: Pensions, Actuarial Valuation, Gain, Loss, Analysis of Surplus, Ireland.

Resumo

Os planos de pensões proporcionam uma fonte de rendimento no período de reforma, adquiridos durante a vida ativa. São extremamente importantes porque constituem uma das principais fontes dos benefícios facultados pelas empresas aos seus colaboradores, e também da poupança nacional.

As responsabilidades de um plano de pensões representam o montante de capital que será necessário para o pagamento de benefícios futuros.

A principal preocupação de um atuário no processo da avaliação de um plano de pensões é identificar se os passivos estimados correspondem de facto aos compromissos assumidos. Para mensurar e analisar se uma avaliação atuarial está do lado seguro, o atuário precisa de efetuar uma análise de ganhos e perdas atuariais.

Durante um período de cinco meses realizei um estágio na Mercer, empresa de consultoria que atua em 3 grandes áreas: Carreira, Pensões e Investimentos e Benefícios. Este relatório é o resultado final da experiência obtida no estágio ao longo desse período. O principal objetivo foi estudar as bases necessárias para a realização de uma avaliação atuarial, bem como uma análise das causas subjacente a cada elemento que contribui para o ganho ou perda atuarial. Todas as ações foram desenvolvidas no contexto da realidade irlandesa.

Palavras-chave: Pensões, Avaliação Atuarial, Ganho, Perda, Análise do Excedente, Irlanda.

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List of Abbreviations

Abbreviation	Meaning
AA	Attained Age
ABO	Accumulated Benefit Obligation
AL	Accrued Liability
AOS	Analysis of Surplus
ASP	Actuarial Standard of Practice
AVC	Additional Voluntary Contribution
DB	Defined Benefit
EA	Entry Age
EP	Expenses Paid
Exp	Expected
CPI	Consumer Price Index
CARE	Career Average Revalued Earnings
IAS	International Accounting Standard
IPP	Insurance Premium Paid
LT	Last Time
MFS	Minimum Funding Standard
NM	Net Money
NC	Normal Cost
NRA	Normal Retirement Age
PBO	Projected Benefit Obligations
Pen Inc	Pension Increase
PUC	Projected Unit Credit
PVFNC	Present Value of Future Normal Cost
PVPB	Present Value of Projected Benefits
SWO	Social Welfare
TT	This Time
TUC	Traditional Unit Credit
VA	Valuation Age
WAS	Wealth Analytical Service

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1.Introduction

People are living longer and are getting more active at retirement, hence the importance of saving for retirement. A pension scheme offers a source of income for people that experience a reduction in income when retire or consider that the state pension is not sufficient as an income.

Actuaries have a fundamental role in the management of pension schemes. They are qualified to advise about the possible benefit payments, liabilities and look after the interest of all parties involved.

During our Master's studies, we were prepared to perform the actuarial calculations necessaries to evaluate pension schemes. Having been exposed to the theoretical aspect of pensions, I became eager to apply that knowledge through seeking a professional internship in this field. This report is the result of a five months curricular internship at Mercer.

1.1. About the internship

An internship was performed, after finishing the theoretical load of the Master in Actuarial Science, to apply some of the knowledge gained during the Master studies.

Mercer is an American consulting firm, a subsidiary of Marsh & McLennan, specialized in areas of risk, strategy and people. Mercer helps clients by advising and giving solutions based on technology to meet the needs of their client's people. As a result, Mercer has three lines of business: Health, Wealth and Career. As part of the Wealth line of business, Mercer offers advice and solutions for Defined Benefits Pension Plans by having a skillful team of consultants and analysts in pension strategy, investments service, and risk and financial support (Mercer, 2018a).

In Portugal, the Wealth Analytical Service (WAS) department performs, among other activities, actuarial valuation work for 13 countries. The main activities undertaken by the WAS team are funding and accounting valuations, reporting and preliminary slides, projections and internal consolidation work.

For Ireland funding valuations, the WAS performs the calculations needed to meet these requirements. By analyzing and testing the existing data, it performs the actuarial

calculations needed under different assumptions scenarios and (delivering several outputs e.g.: liabilities, cashflows, expected future working lifetime, duration, membership information, etc.) it reconciles both assets and liabilities evolution since the previous valuation, establishing the current funding level and the future contributions required to cover the cost of the benefits (Mercer, 2018b).

As the internship went on, we got to perform all task described before not only for the Irish pension schemes but also for the Spanish pension schemes, getting the opportunity to know about how pensions are managed in each country. In order to perform actuarial valuations we used Mercer's internal software and Microsoft Excel, and familiarized ourselves with their functionality. Early on, we received a weeklong conceptual training about pension funds, followed by a technical training covering Mercer's software, Microsoft Excel functionalities and templates, all of which have enabled us to perform all the expected tasks. Additionally, several other trainings were arranged during the course of the internship that further instilled our knowledge in the field of pensions, allowing us to grow as young professionals.

The goals of the internship were set as follows:

- Provide learning and practical experiences that complement curricular and academic training. At the same time, develop the trainee professionally and empower it with activities at work.
- Enable the execution of activities related to the area of professional training.
- Provide the opportunity to solve technical problems in real context under the guidance of a supervisor.
- Develop work habits, entrepreneurship and a sense of professional responsibility.

1.2. Objectives

During the course of our internship, we realized that is very important to perform an analysis of the evolution of the liabilities from one evaluation period to the other, in every valuation. Further is also very important to compare the liability that we were expecting to have in the previous evaluation, with the liability we are calculating in the current one, only changing data and valuation date. This exercise will help the actuary, in every valuation period, to test the accuracy of the evaluation he/she is performing, to assess

changes in liabilities and contribution levels and review the assumptions by assessing how appropriate they are to estimate the pension scheme liabilities.

This report is intended to review how actuarial valuations are performed and the relevance that an analysis of gains and losses (and of the eventual surplus/shortfall) has on the actuarial valuations of a pension scheme.

Given that we need to protect the privacy of the client, we will not enclose its name or any personal identification of members of the scheme we work on.

This report is structured around five chapters. In Chapter 2, we will review the basic knowledge acquired during the development of the internship, related to pension schemes in Ireland. It is fundamental to understand the terms and concepts given in Chapter 2, since we are describing the basic information needed to be able to understand the Irish Schemes. In Chapter 3, we will review the different types of valuations perform in Ireland, the variety and importance of valuation assumptions and the different methods to perform a valuation. In Chapter 4, we will explain the mathematics needed to perform a gain and loss analysis and the analysis of surplus. In Chapter 5, we will apply all the concepts in the previous chapters to an Irish scheme and present results of our analysis. Finally, the report ends with conclusions and final comments.

2. Pension Plans – Ireland Case

In Ireland, the pension system is composed of two main elements: a State pension system and a system of private, voluntary and supplementary pension provided through different arrangements and regulated by the Pension Authority under the Pension Act 1990. The main part of the private pension arrangements are provided by employers to some or all employees as part of their salary package, known as occupational pension schemes, which are the schemes we worked on during the internship period. The main references for this chapter are: (The Pensions Authority, 2016a, 2016b).

2.1 State Pension

The Irish State provides two types of pensions, payable from the age of 66 (Department of Employment Affairs and Social Protection, 2016):

- Contributory: payable to people who have made enough social insurance contributions.
- Non-Contributory: payable to people who satisfy the Government's means test and do not qualify for the Contributory State Pension.

  Irish actuarial valuations are performed every three years. For our case study (please, refer to Chapter 5) last actuarial valuation was performed on 01 January 2015, this time valuation was done on 01 January 2018. Hence is important to keep in mind the following offset: as of 01 January 2015, the full single person's contributory State Pension was €11,975.60 per annum (Department of Employment Affairs and Social Protection, 2014). From 01 January 2018, is €12,391.60 per annum (Department of Employment Affairs and Social Protection, 2017).

2.2 Occupational Pension Scheme

These are pension plans created by employers to be offered to their employees providing benefits such as tax free lump sum, benefits on retirement, benefits to dependents on death in service or death after retirement. These benefits are generally based on the final earnings, average earnings during the service or the value of the pension fund at retirement. The main advantage of these schemes is that the employer helps paying the cost of the benefits.

Occupational pension schemes are established under trust or by legislation. All the different schemes managed during the internship at Mercer were set up under trust where a trustee manages the assets of the pension scheme in a trust fund. Trustees must guarantee that schemes are run properly and protect the rights of all scheme members, according to the trust law and the Pensions Act 1990 (Irish Statute Book, 2018)

We classified the members of a pension scheme as follows:

- Active members: members who are currently in service.
- Deferred members: those who were members of the scheme but left the company.
- Pensioners: members who have retired and are receiving a pension benefit.

2.2.1 Types of Occupational Pension Scheme

Defined Contribution schemes (DC schemes): the amount of the pension at retirement depends on the amount of member's contributions and contributions made by the employers, the return on the investment and the cost of buying the pension.

Defined Benefit schemes (DB schemes): the amount of the pension at retirement is set in advance and usually depends on the time of service and the salary at retirement or earned during the member´s career.

During the internship, we performed actuarial valuations on Defined Benefit schemes; hence we are going to see this type of scheme in detail ahead.

2.3 Defined Benefit Schemes

In a DB scheme, the amount of the benefit is fixed in advance and the contributions has to be reviewed and adjusted from time to time to make sure the accumulation of the contributions and returns will be enough to cover the promised amount of benefit. It is not possible to know in advance how much the scheme will cost. Usually, the member's contribution rate is a fixed percentage of the salary, and the employer rate of contribution is adjusted, increasing or decreasing, as needed.

It is important to mention that benefits provided under a DB scheme are not guaranteed. If the scheme's trust fund (formed by the contributions made by the employer and employees) is not enough to pay the benefits, and if the company is not in position to pay them from their business accounts, then the benefits have to be reduced.

At least every three years, the actuary needs to perform an ongoing valuation to value the liabilities of the scheme, compare it to the value of the scheme's assets and calculate the amount of money that must be contributed in future years to meet the scheme's payable benefits. Finally, an actuarial report reflecting the results of this review must be written.

2.3.1 Main features of a DB pension scheme

- Employer's contributions may change, depending on the results of the actuarial valuations. The level of contribution rate will vary according to the investment return, the cost of buying a pension and others.
- The amount of benefit to be paid usually takes into account the amount of the State Pension paid to the member.
- Funding Standard valuation: by law (Irish Statute Book, 2018) each year a revision must be made to ensure the assets in the fund can meet the liabilities accrued up to date.
- Final Salary DB scheme benefits the members that stay in the scheme until retirement as the benefit depends on the member's final salary.

2.3.2 Career average schemes

The benefit is based on the average earning received during the entire member's career. These earnings may be subject to a revaluation until retirement with some index e.g.: Consumer Price Index (CPI). These schemes are known as Career Average Revalued Earnings (CARE).

2.3.3 Integration with the State Pension

An integrated pension scheme is a scheme where the benefit or the pension payable takes into account the State pension to calculate:

a) the amount of pension payable so that the total of the combined pension from the State and from the occupational scheme, is at the level aimed;

b) the level of contribution payable to an occupational scheme considers the offset from scheme benefits to allow for the State pension. Since employers and employees make considerable social contributions, makes sense to consider the Pension State in the calculation of benefits for private schemes. Next, we will go through some methods to integrate with the State pension:

- Integration by salary offset: Since the member is paying social contributions, there is a part of the salary that is taken care by the State Pension. To calculate the pensionable salary, the pension state is deducted from the member's actual salary. Then, the occupational pension and the state pension add up to the intended total pension, based on the full salary. The member's contributions are based on the pensionable salary - which is, of course, lower than the member's actual salary.

  This is the method we will use in our case study (Chapter 5).

- Integration by pension offset: the pension is calculated and the State Pension is deducted from this amount. The difference is the pension payable from the occupational pension scheme.

2.4 Additional Voluntary Contribution (AVC)

AVCs are additional contributions that the scheme members can make, in addition to their normal contributions, to increase their retirement benefit.

A pension scheme can provide benefits payable on death, benefits payable on leaving service, and benefits payable on retirement.

2.5 Benefits payable on death

2.5.1 Death in service

The benefit is provided as long as the member dies in employment. The benefit can be one or a mix of the following: a lump sum, a refund of contributions made (including AVCs), a spouse's pension or/and orphan's pension.

2.5.2 Death in retirement

Provides benefit in the event of death in retirement. The benefit can be: a widow/dependent's pension, a guaranteed period where your pension will be paid even if the member dies after retirement.

2.6 Benefits payable on leaving service

If the employee leaves the employment, but has been a member of the scheme for more than two years, he/she is entitled to one of these following options:

- Leave the benefit in the scheme until retirement (preserved or statutory benefit). The preserved benefit will be revalued each year until retirement by the increase in the CPI for that year, capped at 4%.

  To calculate the preserved benefit, we need to take into account the benefit the member has earned, calculating it as a proportion of the benefit the member would have earned, had he/she remained in the scheme until the normal retirement age (NRA), considering that the benefits due to the member at NRA are assumed to accumulate evenly over the entire reckonable service.

  Preserved benefits are revalued at the end of every year, starting from 1996 or the year when the employment terminated, the latest.

- Transfer the value of the pension benefit to another pension scheme.

If the member has less than two years of qualifying service, the usual option offered to the member is a refund of contributions less tax. If the member decides to keep the benefit in the scheme, it is not entitled to a revaluation (non-preserved or non-statutory benefit).

2.7 Benefits payable on retirement

2.7.1 Normal Retirement

Benefit is provided when members reach the normal retirement age, which is set in the documents of an occupational benefit scheme and it is normally between 60 and 70. State pension age is currently at 2018 age 66 but will change in the coming years.

2.7.2 Early Retirement

Benefit is provided if the member decides to retire before the NRA, normally after age 50 or within 10 years of NRA. Early retirement benefits are usually lower than the Normal retirement benefits, since there is the additional cost of paying them earlier and for a longer period.

2.7.3 Illness / Disability

An occupational pension plan may provide a benefit if the member is unable to work due to a serious illness or disability.

3. Actuarial Valuations – Ireland Case

Actuarial valuations are performed: (i) to check if the pension scheme can cover the promised benefits; (ii) to evaluate the cost of the pension plan; (iii) to determine the annual rate of contribution of the company; (iv) to set the plan funding level; (v) and to develop technical and actuarial reports.

Actuarial valuation may be required in three different scenarios:

- For determining if the fund satisfied the minimum funding standards required by the regulatory authority, known as Minimum Funding Standard (MFS) valuation (Irish Statute Book 2018, Part IV).
- For accounting purposes, necessary for the sponsoring company (International Accounting Standard (IAS) 19 valuation) (McNally and O'Connor, 2013).
- To determine the funding level (value of assets in relation to the value of the accrued liabilities of the scheme, taking into account past service) and the recommended contribution rate (On going valuation) (Society of Actuaries in Ireland, 2017).

Irish legislation requires performing On Going valuations every three years.

During the internship we had the opportunity to perform all three actuarial valuations explained before, however in this paper, from now on, we are going to focus on the On Going valuation, which is the one we are going to apply in our case study in Section 5. We decided to focus on this type of valuation, since it was the one we had the most exposure to, and got involved in throughout the course of the internship.

3.1 Actuarial Assumptions

Assumptions are set by the scheme actuary, in agreement with the trustee and the employer. According to the Actuarial Standard of Practice Pension 1 (ASP PEN-1), actuaries have free judgement when it comes to choose the assumptions they will use to perform the actuarial valuation. However, actuaries need to explain properly the method and reasoning behind the choice of the assumptions, as well as variations between assumptions chosen and actual experience (Society of Actuaries in Ireland, 2017).

It is very important to assess the sensitivity of the valuation to changes in key assumptions. The approach to follow is recalculating the liabilities with a change in a key assumption

while the other assumptions remain unchanged. Liabilities should decrease when using higher discount rates and should increase with the increase in expected salary, pension growth and improvement in mortality. With lower expected age of retirement, liabilities should also increase.

In the following two sections (3.1.1 Financial Assumptions and 3.1.2 Demographic Assumptions) we use as reference: (European Actuarial Consultative Group, 2001) and (The Actuarial Education Company 2007, Ch. 16)

It is worth noting that in all of Ireland's actuarial valuations we perform at Mercer, we do not set the assumptions since assumptions are chosen by the scheme actuary and must be in agreement with the trustee and employer.

3.1.1 Financial Assumptions

The aim of financial assumptions is to anticipate the effect that market forces will have on the cost of the plan through several rates that will help to project the amount of benefits that will be payable and its present values. The most common financial assumptions are:

- Discount rate: it is used to discount future benefits in order to calculate scheme's liabilities. The idea behind the choice of a discount rate assumption is to reflect the expected future rate of return of the pension scheme's assets. Discount rates assumptions are commonly differentiated for a pre and post-retirement period (different rates for future pensioners members and current pensioners members).

  To set a proper discount rate assumption, the actuary must take into account the company's investment policy, investment performance and volatility, cash flow, market trends, risk to which the scheme is exposed, benefit's changes, among others, and has to consider the size of the scheme to ponder own scheme experience. The discount rate has a direct impact on the liabilities meaning that the lower the discount rate is, the more conservative the scheme's liabilities are. Higher discount rates lead to liabilities that are less conservative (lower liabilities).

- Price Inflation rate: Is a significant financial assumption to calculate pension obligations, and usually determines the assumptions for salary increase and pension increase. To set a proper price inflation rate the actuary must consider the evolution of

the CPI and inflation forecast. When the rest of the assumptions remain unchanged, a higher inflation assumption leads to a high value on pension liabilities.

- Rate of salary increase: Salaries will change over time for many reasons such as inflation, salary scale, promotions, etc. Since the amounts of benefits are usually based on earnings (based on final salary, average salary, etc.), is necessary to consider the future amount of earning the member will be making in order to spread the cost evenly.

  To set a proper assumption on salary increase, the actuary needs to consider the compensation data the company has (if available), or reference data from the scheme's industry, current compensation practice, predictable changes on the company's salary increase policy, among others. The assumption of salary increase can be set with: rates that vary by period or age; different rates for different members categories (staff, executives, etc.); or just a unique rate that applies for all members of the pension scheme.

  Salary increase assumption will only impact the liabilities for active members. When the rest of the assumptions remain unchanged, a raise on the assumption of the salary increase rate will produce a higher liability. On the contrary, a lower rate of salary increase will lead to a lower liability.

- Many pension schemes reviewed during the developing of the internship consider other financial assumptions as the rate of increase of the State Pension (social welfare) or/and rate of pension increase, which are normally linked to the price inflation assumption.

3.1.2 Demographic Assumptions

We are trying to know how the participant's behavior will affect the cost of the plan through several rates that will help us project when benefits will be payable. The most common demographic assumptions are:

- Mortality rate: It is important to predict the survival rates of the scheme members with the use of a mortality table. Pension scheme's assumptions can be set by using two different mortality tables: one for pre-retirement members and another one for post-retirement members.

Usually the actuary uses standard mortality tables as the starting point for setting the mortality assumption, and makes adjustments to fit the standard mortality table to the scheme experience. The most common adjustment used is known as age offset which is using a different age than the actual member's age to obtain the member's mortality rate.

- Disability rate: As we mentioned in Chapter 2, some schemes may have disability benefits. In this case, we need to consider the probability of any member becoming disable.
- Retirement age: Since the time of retirement is not known with certainty in advance, the actuary needs to make assumptions about the age at which the member will start receiving the retirement benefit. For this reason, it is necessary to construct rates of retirement over all ages when retirement can occur. In order to do this, the actuary can use the scheme's experience or, if it is a small or new scheme, he/she can use industry experience.
- Withdraw rates: As we explained in Chapter 2, members can leave the company before retirement but continue to be entitled to the benefit in the scheme. The actuary needs to calculate the rate of service terminations expected to occur at every year at different ages. As usual, to calculate this rate, the actuary can use the scheme's own experience or the industry experience.

As previously mentioned in this chapter, in Ireland, assumptions can be chosen at the discretion of the actuary. These choices may cause a gain or a loss on liabilities, since setting assumptions is not a precise mathematical process but rather a judgment exercise of the actuary. For this reason, it is very important to compare, when the next evaluation is performed, the actual behavior of the plan versus the one expected when assumptions were set in the previous valuation exercise.

3.2 Actuarial Funding Methods

In this section we will review the most common calculations used during the internship period at Mercer. Our main references are: (Mercer, 2017a) and (The Actuarial Education Company, 2007).

An Actuarial Funding Method is the payment plan a company needs to follow to be able to cover its pension expenses (Mercer, 2017a). The most common funding methods are:

- Unit Credit: can be divided in Projected Unit Credit and Traditional Unit Credit.
- Entry Age method.
- Attained Age method.

The actuary calculates the expected future benefit payments for each scheme member using company's participant data and plan provisions. These future benefit payments consider the member's earnings, service history, and additionally expectation of several decrements like death, withdraw, disability or retirement. Each future benefit is discounted from the future date of payment until the valuation date, using actuarial assumptions.

If assumptions are set correctly, the company could theoretically set aside that amount of money in a fund and it would be enough to cover the payments from the scheme plan, including those for service the participant is expected to earn and future pay increase.

During the following pages, we are going to explain how to obtain the following figures, according to each funding method:

- Normal Cost (NC): Is the cost of providing a retirement benefit for an additional year of service.
- Accrued Liability (AL): Present value of benefits allocated to past service.
- Present Value of Future Normal Costs (PVFNC): Present value of benefits corresponding to present and future years of service. Also includes the NC.
- Present Value of Projected Benefits (PVPB): Present value of all benefits expected to be paid to all scheme members; $\mathrm{PVPB} = \mathrm{AL} + \mathrm{PVFNC}$.

The figures previously reviewed apply only for active employees. Liabilities for deferred and pensioners are already funded. We are going to review how to calculate their liabilities on section 3.2.5.

On the following figure, we can understand better the different split between the liabilities explained previously:

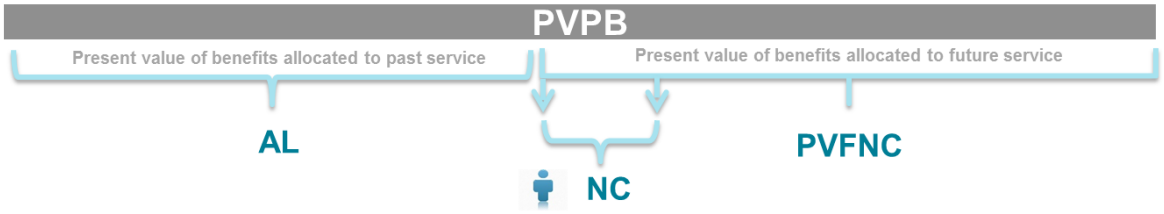

Figure 1 Type of Liabilities. *Source: Mercer (2017a)*

3.2.1 Projected Unit Credit Method (PUC)

This method is based on the principle that a member who entered the scheme at entry age (EA) and retired at NRA is expected to retire with N years of service.

If the final benefit is known, or can be estimated, the amount corresponding to 1/N of the benefit at retirement can be financed in each year of service, so that upon reaching retirement age, all the benefit is fully funded. In other words, the present value of projected benefits is determined and divided by the total estimated length of service and in each year a portion of this amount is funded.

In the PUC method the benefit depends on the projected salary to retirement date.

There are two different forms of calculations (known as Pro-Rate and Calculate) under the Projected Unit Credit Cost method. This different approach is only applicable when the benefit is service related and has a maximum level, otherwise the two calculations will produce the same results as long as the accrued liability is calculated with the same rate.

- ***Accrued Liability*** **(AL):** Is the present value of the accrued benefit, corresponding to past service, multiplied by the annuity starting at age NRA, discounted by the interest rate and adjusted by the probability of survival from the valuation age (VA) until NRA (other decrements can also apply).

  This reasoning applied for both forms of calculations, Pro-Rate and Calculate, under the PUC method.

  $$AL = AccruedBenefit_{VA} * a_{NRA} * v^{NRA-VA} * {}_{NRA-VA}p_{VA} \qquad (3.2.1.1)$$

  Where:

  a_{NRA} represents an annuity that pays according to the scheme rules, so long as a life aged NRA is alive;

  $v = \frac{1}{1+discount\ rate}$ represents the discount factor;

  ${}_{NRA-VA}p_{VA}$ represents the probability of an individual aged VA is alive and working at the company at NRA (other decrements can also be in force);

  $AccruedBenefit_{VA}$ is the accrued benefit at valuation age, considering the portion of benefit that corresponds to past service.

If the benefit is defined as a function of salary and service, then we can have two different ways of calculating the Accrued Benefit:

- PUC Pro-Rate:

$$AccruedBenefit_{VA} = \% * Salary_{NRA} * Service_{NRA} * \frac{VA - EA}{NRA - EA} \qquad (3.2.1.2)$$

Where:

$\frac{VA - EA}{NRA - EA}$ represents the ratio between the years of past service until valuation date and the total years of service until retirement age;

$Salary_{NRA}$ represents the salary projected at NRA;

$Service_{NRA}$ represents the service to NRA.

Hence,

$$AL = \% * Salary_{NRA} * Service_{NRA} * \frac{VA - EA}{NRA - EA} * a_{NRA} * v^{NRA-VA} * {}_{NRA-VA}p_{VA} = PVPB_{VA} * \frac{VA - EA}{NRA - EA} \qquad (3.2.1.3)$$

where $PVPB_{VA}$ represents the present value of future benefits.

- PUC Calculate:

$$AccruedBenefit_{VA} = \% * Salary_{NRA} * Service_{VA} \qquad (3.2.1.4)$$

Where $Service_{VA}$ represents the service to valuation date.

The accrued liability obtained from PUC Pro-Rate is lower than the AL obtained from PUC Calculate. We can show this by looking at both formulas of $AccruedBenefit_{VA}$: in case of PUC Pro-Rate, the ratio reduces the AL (Atteridg, Daskais and SZE, 1991).

- ***Normal Cost (NC):*** The NC is the increase in the member's benefit during the year, multiplied by the life annuity starting at NRA, discounted by the interest rate and adjusted by mortality (other decrements might apply as well). The formula to obtain the NC follows:

$$NC = (AccruedBenefit_{VA+1} - AccruedBenefit_{VA}) * a_{NRA} * v^{NRA-VA} * {}_{NRA-VA}p_{VA} \qquad (3.2.1.5)$$

Where $AccruedBenefit_{VA+1} - AccruedBenefit_{VA}$ is the benefit accrued in the present year.

We can obtain the following formulas for the different PUC methods:

- PUC Pro-Rate:

$$NC = (AccruedBenefit_{VA+1} - AccruedBenefit_{VA}) * a_{NRA} * v^{NRA-VA} * {}_{NRA-VA}p_{VA} = PVPB_{VA} * \frac{1}{NRA - EA} \quad (3.2.1.6)$$

- PUC Calculate:

$$NC = AL_{VA+1} - AL_{VA} \quad (3.2.1.7)$$

3.2.2 Traditional Unit Credit Method (TUC)

Is also known as non-projected unit credit cost method. The main difference between the calculations using the TUC and PUC methods is that the benefit in the TUC method will depend on the current salary, while for the PUC method, as described before, the benefit depends on the projected salary.

TCU method is frequently used to calculate the Accumulate Benefit Obligation (ABO). The ABO is an approximate measure of the pension scheme's liabilities, and is estimated based on the assumption that the pension plan is winding up, hence does not consider any future salary increases. Projected Benefit Obligations (PBO) considers that the pension plan is ongoing, therefore takes into account salary growth and refers to the present value of retirement benefits earned by employees, using an estimate of future compensation levels.

3.2.3 Entry Age Cost Method (EA Cost Method)

Within the Entry Age Cost method as a fixed value, the cost of the plan is funded over the entire member career. The NC is calculated at the members EA and does not change until NRA. Then, the NC will be the level amount, or level percentage of pay, that would precisely fund each member's prospective benefits, if the member contributed from the date of entry to the scheme until retirement date.

At EA Cost Method, the present value of future normal cost must be equal to the present value of future benefits.

- ***Normal Cost (NC):*** We are going to determine the NC assuming that, at entry age, the PVPB should be equal to the PVFNC, which means AL is equal to zero. The only moment where AL will be equal to zero, is at entry age since there is no past service.

- PVPB at NRA: $PVPB_{NRA} = Benefit * \ddot{a}_{NRA}$
- PVPB at EA: $PVPB_{EA} = PVPB_{NRA} * v^{NRA-EA} * {}_{NRA-EA}p_{EA}$
- PVFNC at EA: $PVFNC_{EA} = NC * \ddot{a}_{EA:\overline{NRA-EA}|}$

where $\ddot{a}_{EA:\overline{NRA-EA}|}$ represents a temporary annuity due from entry age to retirement age.

We obtain the NC formula as follows:

$$PVPB_{EA} = PVFNC_{EA} \Leftrightarrow PVPB_{EA} = NC * \ddot{a}_{EA:\overline{NRA-EA}|} \Leftrightarrow$$

$$NC = \frac{PVPB_{EA}}{\ddot{a}_{EA:\overline{NRA-EA}|}} \qquad (3.2.3.1)$$

- ***Accrued Liability*** **(AL):** The calculations to obtain the AL at any point after EA are very straightforward as it shows bellow:

$$AL = PVPB_{VA} - PVFNC_{EA} = PVPB_{VA} - NC * \ddot{a}_{VA:\overline{NRA-VA}|} \qquad (3.2.3.2)$$

3.2.4 Attained Age Cost Method (AA)

The Attained Age Cost methods helps to determine the average future cost, expressed as a percentage of earnings, as long as all the assumptions presumed in the actuarial valuation are met. For the majority of pension plans, that provide benefits depending on salary, the future normal funding rate is calculated as follows:

$$NC\ (\%) = \frac{PVPB - AL}{PVFSAL} * 100 \qquad (3.2.4.1)$$

where $PVFSAL$ represents the Present Value of Future Salaries, and can be obtained with the following formula:

$$PVFSAL = Salary_{VA} * \sum_{k=0}^{NRA-VA-1} (1+j)^k * v^k * {}_kp_x \qquad (3.2.4.2)$$

where j is the expected rate of salary increase.

- ***Normal Cost*** **(NC):** Will be obtained by applying the NC (%) to the current member's payroll. Represents the present value of future liabilities distributed over the future years of service in percentage of estimated future salaries.

- ***Accrued Liability*** **(AL):** Is obtained following the same approach as in Unit Credit cost method. Depending on the data received, either PUC Pro-Rate method or Calculate method can be used.

3.2.5 Liabilities for deferred and pensioners members

- Deferred Members:

$$AL = PensionDef_{VA} * a_{NRA} * v^{NRA-VA} * {}_{NRA-VA}p_{VA} \quad (3.2.5.1)$$

Where

$PensionDef_{VA} = Preserved * PastReval * (1 + Reval)^{NRA-VA} + NonPreserved$

$Preserved$: Represents the amount of preserved or statutory pension.

$Past\ Reval$: Represents the rate of revaluation to which the benefit has been subject to until valuation date.

$Reval$: Represents the assumption taken on revaluation.

$Non - Preserved$: Represents the amount of non-preserved or non-statutory pension.

- Pensioners Members:

$$AL = Pension_{VA} * a_{VA} \quad (3.2.5.2)$$

Where a_{VA} represents the annuity factor at valuation date.

4. Gains and Losses Analysis – Ireland Case

The initial stage of an actuarial valuation is the data treatment. Data needs to be as accurate as possible and changes in the information's members, from one evaluation to the following, need to be explained since it might have an impact on the liabilities.

During the internship, we got to perform several data treatment in different schemes, analyzing changes and confirming with each client the changes found. From these exercises, we gain expertise to identify which information might affect the liability and why it is important to assess the changes from one valuation to the next one. Birth date, sex, salary, pension amount, hire date, exit date, among others, are key variables in every valuation.

As we have mentioned earlier in this report, it is necessary to analyze the evolution of the liabilities from one valuation to the following, in order to test if the calculation of liabilities is accurate, to identify changes in liabilities and to review the accuracy of the valuation assumptions.

In order to set assumptions, the scheme actuary uses mathematical methods which inevitable will lead to errors, underestimating or overestimating the retirement plan liabilities. When we overstate the liabilities, we are in the presence of an actuarial gain (actual liability is lower than the expected liability). When we underestimate the liabilities, we produce an actuarial loss (actual liability is greater than the expected liability).

Through the development of this chapter (and of the following one) we will encounter the following notation: (Gain)/Loss, Gain/(Loss); meaning that not all negative results will necessarily mean that we are in the presence of a loss. We have to keep in mind the nature of the element we are analyzing, if it is a liability or an asset, to determine how the gain and loss will arise (negative or positive sign).

There are three main elements we need to consider when analyzing gains and losses: (Dreher, 1959)

1. Events occurred during the valuation period, which affect the pension fund. Some of these events are:

1.1. Payment of benefits: payments of pensions, commutations and lump sums on retirement, on death in service or in retirement, purchase of annuities, among others.

1.2. Payment of administrative expenses: expenses related to actuarial, administration, audit fee, pension consultancy, legal and miscellaneous expenses.

1.3. Return on investment: investment income, net return on investment, change in market value of investment, etc.

It is important to mention that every time we perform a valuation on a pension scheme, we are required to assess the accounts, assets and cashflows for each year within the intervaluation period; however, in this report we will not disclose in detail the results of this assessment due to the client privacy policy.

2. Events occurred during the valuation period, which affect the future liabilities:

2.1. Different decrements that might occur to active members as death, withdraw, disability, illness, retirements. Decrement that might affect retirees: death.

2.2. Changes that can affect benefit liabilities as salary changes, employee status changes (full time/part time), etc.

2.3. New scheme members.

3. Events occurred during the valuation period, which affect the estimated liabilities, but are not related to experience:

3.1. Errors in the data treatment process.

3.2. Changes in benefits, in actuarial valuation methods, in assets valuations and/or assumptions.

4.1 Calculations related to Gain and Loss analysis

For this section we will follow the gain and loss analysis's methodology performed in Ireland service (Mercer, 2017b). To perform the gain and loss analysis specifically for an Irish scheme, we will need the following information relevant for the calculations:

- Last time (LT) assumptions: pre-retirement rate, post-retirement rate, pension increase, salary increase, social welfare increase (SWO increase), revaluation and salary offset.
- Data: we will need the following this time (TT) data: member's birth date, gender, leave date (if applicable), salary, pensionable salary, salary offset, actual revaluation

for the first year ($Reval_1$), actual revaluation for the second year ($Reval_2$), actual revaluation for the third year ($Reval_3$), member status, pension amount.

From LT data we will need: member's status, salary, pensionable salary, salary offset and pension amount.

- Valuation results: we will need LT AL, LT NC and TT AL.

We will perform the calculations described in the next sections, to analyze the evolution of the liability we were expecting versus the actual liability. We perform the calculations per member, keeping in mind the changes in data each member was subject to, if any.

4.1.1 Leave Date

We will assume the following, regarding the leaving date of the members:

- If the member has status active at this time valuation, then the leave date will be the valuation date.
- If the member is a deferred member at this time valuation, then:
  - If it is a new deferred member, then the leave date will be the leave date informed on the data received.
  - If it was a deferred member on last valuation, then the leave date will be this time valuation date.
- If the member is a pensioner member at this time valuation, then:
  - If it is a new pensioner member, then the leave date will be the retirement date informed on the data received.
  - If it was a pensioner member on last valuation, then the leave date will be last time valuation date.

4.1.2 Roll Forward Rate

As mentioned in previous chapters, we might have different discount rates for pre and post retirement period (and for post-retirement period we might have different rates based on the current status of the member: pensioners and non-pensioners members). Under the roll forward calculation, we will consider the last time post-retirement rate for members who were pensioners at last valuation, and the last time pre-retirement rate for any other member status.

4.1.3 Estimated Interval Benefit

We will estimate the amount of benefit that pensioners accrued during the valuation period.

- If the member is a new pensioner, then: $TT\ Pension\ Amount * t$,
  where t represents the period of time between leave date and valuation date.
- If the member is a pensioner on this valuation, and was a pensioner on last valuation, then: $\frac{(TT\ Pension\ Amount + LT\ Pension\ Amount)}{2} * Interval$,
  where $Interval$ refers to the time between both valuations. In Irish valuations, Interval will always be equal to 3.
- For any other type of members, will be zero.

4.1.4 Expected AL (Roll Forward)

The Roll Forward is the calculation to obtain the expected AL.

$$(LT\ AL + LT\ NC * u) * (1 + Roll\ Forward\ Rate)^{Interval} - Estimated\ Interval\ Benefit * (1 + Roll\ Forward\ Rate)^{\frac{t}{2}} \quad (4.1.4.1)$$

where u represents the period of time between LT valuation date and the leave date. We only have NC for active members, hence the NC for deferred or pensioners members is equal to zero.

4.1.5 (Gain) / Loss

$$Actual\ AL - Expected\ AL \quad (4.1.5.1)$$

4.1.6 % (Gain) / Loss

$$\frac{(Gain)/Loss}{Expected\ AL} \quad (4.1.6.1)$$

Next, we will take a closer look to stayer members:

4.1.7 Expected Pensionable Salary

Only applies for active stayer members. We will calculate the expected pensionable salary:

$$LT\ Salary * (1 + LT\ SalaryInc)^{Interval} - LT\ Salary\ Offset * (1 + LT\ SWO\ Increase)^{Interval} \quad (4.1.7.1)$$

4.1.8 AOS Stayer Items

We will calculate the effect on the liability of the assumptions taken versus the actual experience, based on the status of the member. In each calculation we are removing the effect of the main assumption that affects each type of member, and we take into account the actual experience.

- Active stayers:

$$Expected\ AL * (\frac{TT\ Pensionable\ Salary}{Expected\ Pensionable\ Salary} - 1) \qquad (4.1.8.1)$$

- Deferred stayers:

$$Expected\ AL * (\frac{Reval_1 * Reval_2 * Reval_3}{(1 + LT\ Reval\ Increase)^{Interval}} - 1) \qquad (4.1.8.2)$$

- Pensioner stayers:

$$Expected\ AL * \left(\frac{TT\ Pension\ Amount}{LT\ Pension\ Amount * (1+LT\ Pension\ Increase)^{Interval}} - 1\right) \qquad (4.1.8.3)$$

4.1.9 Pension Increase:

The following calculations only apply for pensioner stayers. The calculation to obtain the actual annual increase on the pension amount is straightforward and follows:

$$\%\ Pension\ Increase: (\frac{TT\ Pension\ Amount}{LT\ Pension\ Amount})^{\frac{1}{Interval}} - 1 \qquad (4.1.9.1)$$

It is important to remember that in Ireland the actuarial valuations are performed every three years. By calculating TT Pension Amount by LT Pension amount, we are obtaining the increase rate of pension amount in three years. By calculating the power of 1 over $Interval$, we obtain the annual rate of pension increase.

If we multiply the rate obtained before by the actual liability, we obtain the actual amount of liability that will be explained due to pension increase for each member. By summing the results obtained for each member and dividing it by the total TT AL for all pensioner stayers, we obtained the actual percentage of pension increase.

4.2 Analysis of Surplus – Ireland Case

In the Gain and Losses analysis, explained in the previous section of this report, we analyze the evolution of the liabilities from one period to the other period and we compare

the liability we were expecting to have with the liability that we are calculating in the next valuation, but only changing the data and the valuation date.

To complete our analysis, we will perform an analysis of surplus that is done by comparing the previous valuations results to those arising now. We will follow Mercer guidelines to do this analysis (Mercer, 2017b) and reference from (Street, 1977) and (Small, 1981).

An actuarial surplus is the difference between the values of assets and liabilities. If the scheme's assets are not enough to cover the liabilities, then the scheme is on deficit.

Next, we will analyze the different sources of surplus. In order to do it, we need to establish a combined discount rate, taking into account the different discount rates we can have in a scheme, and we will denote it aos_{int}. The aos_{int} rate will be the result of weighted discount rates, taking into account the accrued liability per member status and the discount rate that affects each of them:

$$aos_{int} = \frac{(Act\ \ LT\ AL + Def\ LT\ AL) * Pre\ Disc\ Rate + Pens\ LT\ AL * Post\ Disc\ Rate}{Total\ LT\ AL} \qquad (4.2.1)$$

4.2.1 Investment Return on Surplus / (Deficit)

The Surplus / (Deficit) at last valuation will generate a return, which we will calculate as follows:

$$Surplus/(Deficit)_{at\ last\ valuation} * [(1 + aos_{int})^{Interval} - 1] \qquad (4.2.1.1)$$

The Surplus/ (Deficit) arising from the Investment Return is composed of assets and liabilities; hence we can also see it as the result of the difference between formula 4.2.1.2 and 4.2.1.3:

- $LT\ Assets * [(1 + aos_{int})^{Interval} - 1]$ *(4.2.1.2)*
- $LT\ AL * [(1 + aos_{int})^{Interval} - 1]$ *(4.2.1.3)*

4.2.2 Contributions

To calculate how the contributions affect the surplus/(deficit) of the scheme, we will take into consideration the following:

- % Employee Contribution
- % Employer Contribution
- Amount of Employee's Contribution in year 1 after last valuation
- Amount of Employee's Contribution in year 2 after last valuation

- Amount of Employee's Contribution in year 3 after last valuation
- Contributory Salary Roll: is the total pensionable salary amount per year, corresponding to members that contribute to the scheme, and can be obtained as follows:

$$\text{Contributory } Salary\ Roll_t = \frac{Amount\ of\ Employee's\ Contribution_t}{\%\ Employee\ Contribution}, \forall\ t = 1,2,3 \qquad (4.2.2.1)$$

- PUC Rate$_{\text{at last valuation}}$: $\frac{LT\ NC}{Contributory\ Salary\ Roll_{at\ last\ valuation}}$
- Expected PUC Contributions:

$$Exp\ PUC\ Cont_t = Contributory\ Salary\ Roll_t * PUC\ Rate_{last\ valuation}, \forall\ t = 1,2,3 \qquad (4.2.2.2)$$

The Total Expected PUC Contributions ($Exp\ PUC\ Cont$) at the valuation date, assuming contributions are made in the middle of the year, is calculated as follows:

$$\text{Exp } PUC\ Cont = Exp\ PUC\ Cont_1 * (1 + aos_{int})^{2.5} + Exp\ PUC\ Cont_2 * (1 + aos_{int})^{1.5} + Exp\ PUC\ Cont_3 * (1 + aos_{int})^{0.5} \qquad (4.2.2.3)$$

- Actual Contributions: Is the total contributions amount per year ($TT\ Cont_t, \forall\ t = 1,2,3$) including employees and employer contributions. Does not include insurance contributions or expenses.

The Total Actual Contribution ($TT\ Cont$) at valuation date is calculated as follows:

$$TT\ Cont = TT\ Cont_1 * (1 + aos_{int})^{2.5} + TT\ Cont_2 * (1 + aos_{int})^{1.5} + TT\ Cont_3 * (1 + aos_{int})^{0.5} \qquad (4.2.2.4)$$

4.2.2.1 Insurance

The trustee insures the lump sum death benefit. As we mentioned before, in the calculation of actual contributions we did not include the insurance premium paid. Now we will take into account the premium paid effect on the surplus/(deficit) but only if the payment comes from the actual contribution paid:

- Actual Insurance Premium Paid (IPP) in each year: $IPP_t, \forall\ t = 1,2,3$
- The Actual IPP at valuation date will be:

$$Act\ IPP_{ValDate} = IPP_1 * (1 + aos_{int})^{2.5} + IPP_2 * (1 + aos_{int})^{1.5} + IPP_3 * (1 + aos_{int})^{0.5} \quad (4.2.2.5)$$

We will obtain a (loss) on Assets due to insurance denoted bellow:

$$- Act\ IPP_{ValDate} \quad (4.2.2.6)$$

4.2.2.2 Expenses

The expenses are calculated in a way similar to section 4.2.2.1. In this section we will take into consideration expenses paid but only if they come from the actual contributions paid.

- Actual Expenses Paid (EP) in each intervaluation period: AEP_t , $\forall\ t = 1,2,3$
- The Actual EP at valuation date will be:

$$Act\ EP_{ValDate} = EP_1 * (1 + aos_{int})^{2.5} + EP_2 * (1 + aos_{int})^{1.5} + EP_3 * (1 + aos_{int})^{0.5} \quad (4.2.2.7)$$

We will obtain a (Loss) due to expenses denoted bellow:

$$- Act\ EP_{ValDate} \quad (4.2.2.8)$$

We will obtain a Gain/(Loss) due to contributions as follows:

$$TT\ Cont - Exp\ PUC\ Cont - Act\ IPP_{ValDate} - Act\ EP_{ValDate} \quad (4.2.2.9)$$

Finally, on the liability side we will reflect the result of formula 4.2.2.3. On the asset side, we will reflect the result of formula 4.2.2.4 plus 4.2.2.6 plus 4.2.2.8. The surplus/(deficit) will arise from the difference between asset and liability due to Contribution, which must be equal to formula 4.2.2.9.

4.2.3 Investment

We will analyze the effect of assets and net money (contributions, transfer in and other income, such as claims on term insurance policies minus benefits paid, payments and administrative expenses, among others) on the surplus:

- Asset at last valuation: $LT\ Asset$
- Expected Return:

$$LT\ Asset * [(1 + aos_{int})^{Interval} - 1] \quad (4.2.3.1)$$

- Actual Net Money (NM) in each intervaluation period: NM_t , $\forall\ t = 1,2,3$
- The Total Expected Net Money at valuation date will be:

$$Exp\ NM = NM_1 * (1 + aos_{int})^{2.5} + NM_2 * (1 + aos_{int})^{1.5} + NM_3 * (1 + aos_{int})^{0.5} \quad (4.2.3.2)$$

- Expected Asset:

$$LT\ Asset + Expected\ Return + Exp\ ANM \quad (4.2.3.3)$$

We will obtain a Gain/ (Loss) due to investment and we will recorded as an Asset on AOS, as follows:

$$TT\ Assets - Expected\ Asset \quad (4.2.3.4)$$

4.2.4 Pensionable Salary

We will obtain the (Gain)/Loss impact due to pensionable salary from section 4.1.8 AOS Stayer Items, as long as the difference arises from salary changes. The (Gain)/Loss due to pensionable salary will be recorded as a Liability on AOS.

4.2.5 Revaluation

To analyze the effect of revaluation on the surplus we will need to perform the following calculations, always keeping in mind that, as mentioned in section 2.6, the revaluation only applies to the statutory or preserved pension of deferred members:

- Actual annual Revaluation over the period:

$$(Reval_1 * Reval_2 * Reval_3)^{\left(\frac{1}{Interval}\right)} - 1 \quad (4.2.5.1)$$

- Expected Revaluation (LT Reval): Is the revaluation assumption taken on last valuation.
- Actual stayers deferred liability:

$$TT\ Stayer\ Def\ Statutory\ AL = TT\ Stayer\ DefAL * \frac{Amount\ Def\ Statutory\ Pension}{Total\ Def\ Pension} \quad (4.2.5.2)$$

- Expected stayers deferred liability:

$$Exp\ Stayer\ Def\ Statutory\ AL = TT\ Stayer\ Def\ Statuory\ AL * \left(\frac{1+LT\ Reval}{1+Actual\ annual\ reval}\right)^{Interval} \quad (4.2.5.3)$$

We will obtain a (Gain)/Loss due to Revaluation, and we will record it as a Liability on AOS, as follows:

$$TT\ Stayer\ Def\ Statutory\ AL - Exp\ Stayer\ Def\ Statutory\ AL \quad (4.2.5.4)$$

4.2.6 Pension Increase

We will calculate the impact of the pension increase assumptions versus the actual increase in the liability of pension stayers. We need to perform the following calculations:

- Actual pension increase (Actual Pen Inc): We will use the calculation obtained in point 4.1.9.
- Expected pension increase (LT Pen Inc): Represents the assumption taken for pension increase.
- Actual pensioner liability at this valuation date (TT Stayer Pen Inc AL).
- Expected pensioner liability (Exp Stayer Pen Inc AL):

$$Exp\ Stayer\ Pen\ Inc\ AL = TT\ Stayer\ Pen\ Inc\ \ AL * \left(\frac{1+LT\ Pen\ Inc}{1+Actual\ Pen\ Inc}\right)^{Interval} \quad (4.2.6.1)$$

We will obtain a (Gain)/Loss due to Pension Increase, and we will record it as a Liability on AOS, as follows:

$$TT\ Stayer\ Pen\ Inc\ AL - Exp\ Stayer\ Pen\ Inc\ AL \quad (4.2.6.2)$$

4.2.7 Withdrawals

Now, we will measure the impact on the liabilities arising from withdraw expectation versus actual experience.

- Actual number of withdraws (Actual Withdraw): Number of deferred members on this valuation.
- Expected number of withdraws (Exp Withdraw): Number of expected members to leave the scheme.
- Average profit of leavers with benefits during the intervaluation period (Average profit of leavers):

$$\frac{(Gain)/Loss\ \ of\ Active\ to\ Deferred\ members}{Actual\ Withdraw} \quad (4.2.7.1)$$

We will obtain a (Gain)/Loss due to Withdraw, and we will record it as a Liability on AOS, as follows:

$$(Actual\ Withdraw - Exp\ Withdraw) * Average\ profit\ of\ leavers \quad (4.2.7.2)$$

4.2.8 Members who have left the scheme

We will compare the gain/(loss) arising for members who left the scheme against the actual payments made to such members. These payments are recorded under the concept of lump sums on death in service, lump sums on death in retirement, refund to members leaving service and transfer to other schemes. We should consider the following:

- Active to Exit (Gain)/Loss
- Deferred to Exit (Gain)/Loss
- Pensioner to Exit (Gain)/Loss

For the three previous (Gain)/Loss cases, the (Gain)/Loss will always be a (Gain), equal to minus the expected liability (or roll forward), since, logically, for these members, the actual liability is zero - as they are no longer in the scheme at valuation date. We will also consider:

- Payments to Exits: Actual payments made to members who left the scheme.

The Surplus/(Deficit) arising from members who have left the scheme is equal to asset less liability. The liability side will be the sum of the Active to Exit, (Gain), Deferred to Exit (Gain) and Pensioner to Exit (Gain). The asset will be the amount of Payments to Exit, with a negative sign, since the concept is a payment that reduces the total amount of assets.

4.2.9 Retirements

The effect on the liabilities of members who retired is calculated as follow:

- $TT\ AL\ New\ Retirees$: represents the liabilities calculated this time for new retiree members.
- $Exp\ AL\ New\ Retirees$: represents the expected liabilities calculated using last time liabilities and applying roll forward formula for new retirees.
- $Lump\ Sum\ Ret$: represents the actual payment made to retiree members.

We will obtain a (Gain)/Loss due to Retirements (on Liabilities side) as follows:

$$TT\ AL\ New\ Retirees - Exp\ AL\ New\ Retirees \qquad (4.2.9.1)$$

We will obtain a (Loss) due to Retirements (on Assets side), which makes sense since payments reduce assets, as follows:

$$- Lump\ Sum\ Ret \qquad (4.2.9.2)$$

4.2.10 Change in Benefit

To calculate the effect that a change in benefit might have on the surplus of the scheme, we need to calculate the liabilities including the effect of benefit, and calculate the liabilities without changes in benefit, and then subtract these two amounts, which will be the cost of changing benefits. We also need to take into consideration the present value of this cost (interest accumulation).

4.2.11 New Entrants

The calculation for the effect on the surplus of new entrants is very straightforward, and arises from the loss as actual liabilities of new joiners. It will be recorded on the liability side of AOS, always with a positive sign, resulting as a (Deficit) on the final calculation as the Surplus/(Deficit) is the results of assets less liabilities.

4.2.12 Expected Benefit Paid

We will obtain the Surplus/(Deficit) arising from expected benefit paid by subtracting the following:

- Expected Benefit Paid – Assets:

$$Actual\ Pension\ Paid * (1 + \ Post\ Disc\ Rate)^{\frac{Interval}{2}} \qquad (4.2.12.1)$$

  The $Actual\ Pension\ Paid$ is obtained from the asset scheme report.

- Expected Benefit Paid – Liabilities:

$$Estimated\ Interval\ Benfit * (1 + \ Post\ Disc\ Rate)^{\frac{Interval}{2}} \qquad (4.2.12.2)$$

  The estimated interval benefit is calculated in section 4.1.3.

4.2.13 Change in valuation assumptions

We will obtain the (gain)/loss arising from changes in valuation assumptions as the difference between the values of liabilities calculated on new basis against the value of liabilities on old basis. It will be recorded on the liability side of AOS.

4.2.14 Other Items

It is very complex to explain and calculate all the different sources of surplus. Usually, we consider in Other Items all the remaining sources of Surplus/(Deficit) arising from the specific features of the scheme, for example changes in mortality.

5.Case study

We will consider the following description of benefits to base the valuation on an Irish scheme (Mercer, 2015):

- Eligibility: The Plan is closed to new entrants.
- Pension: The pension on retirement at age 65 (NRA) for an eligible member is 1/60th of Final Pensionable Salary for each year of service with the Company, subject to a maximum of 40 years.

  Pensionable Salary is basic annual salary less a deduction of 1.5 times the Social Welfare Retirement Pension payable to a single person.

  Final Pensionable Salary is the average Pensionable Salary over the three years preceding retirement.

  Pensions are paid monthly, for a minimum period of five years and thereafter for the lifetime of the pensioner. On death after retirement, a widow/er's pension of 50% of the member's pension is payable.
- Early or Late Retirement: Members may retire from the Plan after age 50 or on the grounds of ill-health, or continue working after their NRA.
- Death in Service: In the event of a member's death before the normal retirement date a lump sum of three times basic salary is payable.
- Leaving Service: Members will be entitled to a deferred benefit payable from their normal retirement date based on service to, and Pensionable Salary at, their date of leaving. This deferred pension will be revalued in line with the Consumer Price Index (subject to a maximum of 4% per annum) to the member's normal retirement date.
- Members' Contributions: Members currently contribute 7.5% of Pensionable Salary.

The following table summarized the membership data at the current valuation date (31-12-2018), as well at the previous valuation (31-12-2015). The number of active members in the scheme decreased from last valuation, which is reasonable since the scheme is closed to new entrants. The number of deferred members on the scheme increased from last valuation; however the number of pensioner members remained unchanged.

Active Members	**Current Valuation**	**Previous Valuation**
Number	12	24
Total Pensionable Salaries (€000's pa)	360	802
Average age	47.9	46.7
Average past pensionable service	22.2	19.9
Deferred Members	**Current Valuation**	**Previous Valuation**
Number	26	15
Total deferred pensions (€000's pa) (no allowance for revaluation)	222	54
Average age	51.4	49.3
Pensioners	**Current Valuation**	**Previous Valuation**
Number	6	6
Total pensions payable (€000's pa)	31	33
Average age	73.5	73.1

Table I Membership Data. *Source: Scheme data/Own calculations*

Members changed their status, during the intervaluation period, due to different reasons as we can see in the following Table II.

	Active Members	**Deferred Members**	**Pensioners**
Number at previous valuation	**24**	**15**	**6**
Members ceasing future accrual and taking deferred benefit	(12)	12	
Retirements		(1)	1
Deaths with no survivors			(1)
Number at current valuation	**12**	**26**	**6**

Table II Membership movements. *Source: Scheme data/Own calculations*

Financial assumptions taken during the previous valuation are shown in Table III, as well as assumptions taken for the ongoing valuation. Note that the objective of an ongoing valuation is to ensure the Scheme has sufficient assets to meet the obligation/payments to current and potential future beneficiaries.

	Current Valuation	Previous Valuation
Discount Rate		
Pre-retirement	3.70%	4.25%
Post Retirement		
– current pensioners	0.75%	1.35%
– future retirees	1.95%	3.00%
Benefit Increases		
Price inflation	1.75%	1.50%
Salary Increases/Inflation	1.75%	1.50%
State Pension increases	1.75%	1.50%
Pension increases	0.00%	0.00%

Table III Financial assumptions. *Source: Scheme data*

Some of the demographic assumptions are shown on Table IV below. We have assumed all members will survive and remain in service to normal retirement age, hence no mortality table for pre-retirement period.

Another assumption taken is that members will commute 10% of their projected retirement pension to a lump sum. Also, we have assumed 95% of active members will be married and husbands will be three years older than their wives, the opposite also applies (wives will be three years younger than their husband).

LIFE TABLES EMPLOYED	Current Valuation	Previous Valuation
Life Table (post-retirement)		
Male	S2PMA with CMI 2016 [1.5%] (No age offset)	S2PMA with CMI 2013 [1.5%] (No age offset)
Female	S2PMA with CMI 2016 [1.5%] (No age offset)	S2PMA with CMI 2013 [1.5%] (No age offset)
Life Table (pre-retirement)		
Male	N/A	N/A
Female	N/A	N/A
Future Life Expectations at age 65 – Current Retiree aged 65		
Male	22.4	22.8
Female	24.3	24.8
Future Life Expectations at age 65 – Future Retiree currently aged 40		
Male	24.6	25.6
Female	26.5	27.7

Table IV Demographic assumptions. *Source: Scheme experience table*

We have assumed all members will survive and remain in service to normal retirement age.

The fund value, on which the ongoing valuation is based, is €4,838,410. The Trustees insure the lump sum on death benefit, and the employer meets the cost of this insurance and expenses as they arise in addition to the recommended contribution rate, that is why in our AOS (details on Appendix B) we did not take into consideration Insurance and Expenses (section 4.2.2.1 and 4.2.2.2).

Members can enhance their benefits by making AVC to the scheme. There is no AVC registered in the intervaluation period.

The liabilities of our case study are calculated using Attained Age method in last valuation and in this valuation. Even though is the responsibility of Trustees to choose the liability

method based on the scheme actuary recommendations, we consider the Attained Age method to be appropriate for a scheme closed to new entrants where the profile of the active membership is expected to mature the passage of time, meaning that the average age is likely to increase (The Actuarial Education Company 2007, Ch. 15), matching the characteristics of our case study.

The following table sets out the scheme's accrued liability breakdown by member status and the funding level.

	Current Valuation	**Previous Valuation**
	€000	**€000**
Accrued Liabilities		
Members in service	1,962	3,097
Deferred pensioners	3,659	741
Pensioners	411	489
All members	**6,032**	**4,328**
Fund Value	**4,838**	**3,891**
Unfunded liability	1,193	436
Funding level %	80%	90%
Contribution Rate	44.9%	18.7%

Table V Breakdown scheme's accrued liability. Source: Own calculations

The Contribution Rate is obtained by summing the following two calculations:

- The contribution rate in respect of future service retirement benefits is determined using the Attained Age method at this valuation. This is an appropriate method for a closed scheme, where the profile of the active membership is expected to mature with the passage of time.
- The contribution rate in respect of accrued retirement benefits is determined by firstly deducting the fund value from the value of accrued liabilities and then expressing the

residual unfunded liability as a level % of the future projected Pensionable Salaries of the currently active members.

On the basis of the method (Attained Age) and assumptions employed, the scheme's assets can only cover 80% of the liabilities, and the contribution rate required is 44.9% of Pensionable Salaries payable annually. However, it is important to mention that the scheme does meet the Minimum Funding Standard on the valuation date (Total Liabilities: €4,350,000, Total Assets: €4,838,000).

The previous valuation results can be compared to those arising at the current valuation exercise as follows:

	Liabilities Funding Target	**Assets**	**Surplus/ (Deficit)**
	€000	**€000**	**€000**
Opening Value	4,328	3,891	(436)
Investment return on surplus/(deficit)	529	476	(53)
Contributions in excess	306	326	20
Investment	0	248	248
Pensionable Salary	40	0	(40)
Revaluation	(36)	0	36
Pension Increases	(2)	0	2
Demographic experience and other factors	(115)	(11)	104
Expected Benefit Outgo	(94)	(97)	(4)
Other Movements	(40)	6	46
Valuation basis changes	1,115	0	(1,115)
Value at end of period	6,032	4,838	(1,193)

Table VI Analysis of Surplus. *Source: Own calculations*

The fund return of 5.7% per annum was better than the expected return of 3.92% per annum, under Last Valuation assumptions. As a result, we have a surplus of €247,819 (248 €000) due to Investments (Actual Assets at this valuation: €4,838,410. Expected Assets at this valuation: €4,590,591). It is important to notice that the actual fund return is calculated during the evaluation of assets, which is not an objective of study of this report, and the expected return comes from formula 4.2.1.

The demographic experience and other factors (taking into account withdrawals, exits and retirements) decreased the Deficit of the fund by €104,247. We obtained a (Gain) on liabilities of (€115,151) versus a (Loss) on Assets of (€10,905) due to lump sums paid on retirement.

The change in the valuation assumptions increased the Scheme liabilities by €1,114,952 (The value of liabilities on new basis is €6,031,528. The value of liabilities on old basis is €4,916,576). This was mainly due to the significant reduction in the pre and post-retirement discount rate.

The Scheme has a (Deficit) of (€1,193,118). However, since the Scheme meets the Minimum Funding Standard on the valuation date, there is no need to create a Funding Proposal; however the scheme is exposed to failing the Minimum Funding Standard in the future. Trustees need to pay special attention to how transfer values are calculated. Trustee might need to make sure that if there is any benefit augmentations this must be fully funded at the time the benefit increase is granted. They might also want to review the rates of commutation of pension for cash.

For further calculations and results of the Analysis of Surplus, please refer to Appendix A and Appendix B.

6.Conclusion

The purpose of doing the Academic Internship was not only to get a chance of putting into practice the knowledge acquired during the Master's study, but also to expand this technical knowledge and develop skills that will help me to become a well-rounded professional.

During the internship in Mercer, I performed several activities that I could not cover in extent on this essay. As I mentioned earlier in this paper, I also performed valuation activities for Spain's schemes which allowed me to continuously learn plenty of different methodologies, approaches and techniques relevant to valuations.

Additionally, I also received different trainings on Microsoft Office, specifically on Excel and Portuguese language lessons, among other, that complement my professional growth. I strongly believe that, by working in Mercer, a notorious consulting firm, I have grown professionally and even personally, since working in a Portuguese environment, helped me to be a more flexible kind of person and to adopt a new culture. And despite being out of the scope of this report, I want to mention that by having the opportunity to work for two different services (Ireland and Spain), I was able to identify some difference between them, the main ones being:

- Spanish schemes mostly work with monthly mortality tables, while Irish schemes are set with annual mortality tables.
- In Spanish schemes, to transfer the member's vested rights to another occupational scheme is not allowed, only a few exceptions apply (BBVA, 2015), while Irish schemes allow members to transfer the value of the pension benefit to another pension scheme.
- Irish schemes usually set different discount rates, depending on the status of the member, while most of Spanish schemes we have worked on set a unique discount rate for all members.

Despite having some difference, for both services, the activities of data treatment, posterior analysis of the data, assumptions chosen, assets evaluation, calculation of liabilities and analysis of gain and losses are extremely important activities for performing an actuarial valuation. The whole process definitely helps not only to expand the technical knowledge

acquired in the Master, but also to obtain new knowledge specific to each country I had to work with.

During the valuation of different schemes, one of the most difficult analysis to undertake is the actuarial gain and losses analysis, reason why I have chosen it as a topic for this essay. In order to perform an actuarial gain and losses, the actuary needs to understand and take into consideration every possible change that could happen in the intervaluation period, and its effects on the calculation of liabilities and valuation of assets. The gain and losses analysis is not only important to check if the liabilities calculation is performed correctly and to assess the assumptions taken, but it is also required to perform and disclose in accounting reports.

References

Atteridg, John W; Richard Daskais and Michael Sze (1991). *Projected Unit Credit Cost Method.* Society of Actuaries.

BBVA (2015). *Tengo un plan de pensiones de empleo y dejo la empresa. ¿Qué pasa con mis aportaciones?* Available at: https://www.jubilaciondefuturo.es/es/blog/tengo-un-plan-de-pensiones-de-empleo-y-dejo-la-empresa-que-pasa-con-mis-aportaciones.htm [Accessed October 2018].

Department of Employment Affairs and Social Protection (2014). *Social Welfare Rates for 2015.* [Online]. Available at: https://www.welfare.ie/en/Pages/bud15s6.aspx [Accessed August 2018].

Department of Employment Affairs and Social Protection (2016). *State Pension Age* [Online]. Available at: https://www.welfare.ie/en/Pages/a-retired-or-an-older-person.aspx [Accessed August 2018].

Department of Employment Affairs and Social Protection (2017). *Social Welfare Rates for 2017.* [Online]. Available at: https://www.welfare.ie/en/Pages/bud17s1.aspx [Accessed August 2018].

Dreher, William A (1959). *Gain and Loss Analysis for Pension Fund Valuations.* Society of Actuaries.

European Actuarial Consultative Group (2001). *Actuarial Methods and Assumptions used in the Valuation of Retirement Benefits in the EU and other European countries,* ed. David Collinson. [Online]. Available at: https://actuary.eu/documents/actuarial_methods.pdf [Accessed September 2018].

Irish Statute Book (2018) *Pensions Act, 1990.* [Online]. Available at: http://www.irishstatutebook.ie/eli/1990/act/25/enacted/en/html [Accessed August 2018].

McNally, Bridget and O'Connor, Thomas G. (2013) *Actuarial Valuation of Pension Schemes- An Irish Perspective*. Working Paper. National University of Ireland Maynooth. (Unpublished)

Mercer (2015). *Actuarial Valuation Report.* [Internal Document].

Mercer (2017a). *Actuarial Notebook.* [Internal Document].

Mercer (2017b). *GPS Ireland Valuation.* [Internal Document].

Mercer (2018a). *About Mercer* [Online]. Available at: https://www.mercer.com/about-mercer.html# [Accessed August 2018]

Mercer (2018b). *WAS Lisbon: Our Services and Value Proposition.* [Internal Document].

Small, Howard J. (1981). *A Unified Approach to Pension Plan Gain and Loss Analysis.* Society of Actuaries.

Society of Actuaries in Ireland (2017). *Actuarial Standard of Practice PEN-1.* [Online]. Available at: https://web.actuaries.ie/standards/asp/asp-pen-1 [Accessed August 2018].

Street, Christopher C. (1977). *Another Look at Group Pension Plan Gain and Loss.* Society of Actuaries.

The Actuarial Education Company (2007). *ActEd Study Materials: 2007 Examinations. Subject ST4.* United Kingdom.

The Pensioners Authority (2016a). *How does my pension scheme work?* [Online]. Available at: https://www.pensionsauthority.ie/en/Employers/Pension_guides/How_does_my_pension_scheme_work1.pdf [Accessed August 2018].

The Pensioners Authority (2016b). *What are my pension options?* [Online]. Available at: https://www.pensionsauthority.ie/en/Employers/Pension_guides/What_are_my_pension_options_March_2016.pdf [Accessed August 2018].

Appendix A: Results of Gain and Loss Analysis

In the following tables we will find the results of Gain and Loss analysis arising from calculations reviewed in section 4.1

Formula Reference:						***(4.1.4.1)***
Last Val Status	**This Val Status**	**Count**	**LT AL**	**LT NC**	**All payments from fund**	**Expected AL**
Active	Active	12	1,203,479	56,925	-	1,592,031
Active	Deferred	12	1,893,797	85,689	-	2,291,333
Deferred	Deferred	14	732,743	-	-	851,506
Deferred	Retiree	1	8,718	-	-	10,132
Retiree	Retiree	5	453,631	-	91,888	382,791
Retiree	Exit	1	35,330	-	-	37,115
		45	**4,327,698**	**142,614**	**91,888**	**5,164,907**

Table VII Payments done and roll forward results. *Source: Own calculations*

Formula Reference:			***(4.1.5.1)***	***(4.1.6.1)***		***(4.1.8.1)*** ***(4.1.8.2)*** ***(4.1.8.3)***
Last Val Status	**This Val Status**	**Actual AL**	**(Gain)/Loss**	**Gain/ (Loss) as a % of Expected**	**Roll forward rate**	**AOS Stayer Items**
Active	Active	1,598,470	6,439	0.4%	4.25%	40,091
Active	Deferred	2,222,807	(68,526)	(3.0%)	4.25%	-
Deferred	Deferred	813,228	(38,278)	(4.5%)	4.25%	(36,400)
Deferred	Retiree	621	(9,511)	(93.9%)	4.25%	-
Retiree	Retiree	401,664	18,873	4.9%	1.35%	(1,544)
Retiree	Exit	-	(37,115)	(100.0%)	1.35%	-
Total		**5,036,790**	**(128,117)**	**2.5%**	**n/a**	**2,146**

Table VIII (Gain)/Loss results. *Source: Own calculations.*

We obtain a gain of €128,117 (actual liability: €5,036,790 versus expected liability: €5,164,907). We can conclude that the assumptions chosen by the scheme actuary are accurate.

Appendix B: AOS results

Now we will find the results of AOS arising from calculations reviewed in section 4.2. We will follow the same order described in section 4.2.

Using formula 4.2.1, we will obtain the aos_{int}:

$$aos_{int} = \frac{(3{,}097{,}276 + 741{,}461) * 4.25\% + 488{,}961 * 1.35\%}{4{,}327{,}698} = 3.92\%$$

4.2.1 Investment Return on Surplus / (Deficit)

$Surplus/(Deficit)_{at\ last\ valuation}$	-436,239
$[(1 + aos_{int})^{Interval} - 1]$	0.1223
Investment return on surplus/deficit *(Formula 4.2.1.1)*	**(53,372)**

From formula 4.2.1.2 we obtained the Assets due to Investment return on surplus/(deficit):

$3{,}891{,}460 * [(1 + 3.92\%)^3 - 1] = 476{,}105$

From formula 4.2.1.3 we obtained the Liabilities due to Investment return on surplus/(deficit):

$4{,}327{,}698 * [(1 + 3.92\%)^3 - 1] = 529{,}477$

The surplus/(deficit) is equal to: $476{,}105 - 529{,}477 = (53{,}372)$.

4.2.2 Contributions

PUC Rate $_{\text{at last valuation}}$ 20.00%

Period	2016	2017	2018
Contributory Salary Roll *(Formula 4.2.2.1)*	637,209	433,971	361,966
Expected PUC Contributions *(Formula 4.2.2.2)*	127,442	86,794	72,393
Actual Contributions ($TT\ Cont_t$)	143,116	87,293	74,146
Gain / (Loss)	15,675	499	1,753

Gain / (Loss) = **19,572**

Expected PUC Contributions Timing		Actual PUC Contributions Timing	
2.50	140,309	2.50	157,566
1.50	91,951	1.50	92,479
0.50	73,799	0.50	75,586
Formula 4.2.2.3	306,059	*Formula 4.2.2.4*	325,631

The employer meets the cost of administrative expenses and insured death benefits in addition to the contributions; hence we do not take them into account. The surplus/(deficit) is equal to: $325{,}631 - 306{,}059 = 19{,}572$.

4.2.3 Investment

	Time to This Valuation	Assets and Net Money	Expected Return *(Formula 4.2.3.1)*
Assets at last valuation :	3.00	3,891,460	476,105
Net new money in period 1 :	2.50	99,085	10,004
Net new money in period 2 :	1.50	55,453	3,294
Net new money in period 3 :	0.50	54,138	1,052
Expected Assets at this valuation *(Formula 4.2.3.3)*:			4,590,591
Actual Assets at this valuation :			4,838,410
Gain / (Loss)			**247,819**

4.2.4 Pensionable Salary

(Gain) / Loss	**40,091**

4.2.5 Revaluation

Actual Revaluation over the period (annualized) *(Formula 4.2.5.1)*	0.03%
Expected Revaluation	1.75%
Deferred liability at this valuation date (in respect of statutory pensions) *(Formula 4.2.5.2)*	801,512
Expected liability at this valuation date (in respect of statutory pensions) *(Formula 4.2.5.3)*	843,509
(Gain) / Loss *(Formula 4.2.5.4)*	**(41,997)**

We can also obtain this source from the AOS Stayer Items, and we will take this approach as final:

(Gain) / Loss	**(36,400)**

4.2.6 Pension Increase

Actual increases	-0.14%
Expected increases	0.00%
Pensioner liability at this valuation date (in respect of those receiving increases)	401,664
Expected pensioner liability *(Formula 4.2.6.1)*	403,310
(Gain) / Loss *(Formula 4.2.6.2)*	**(1,646)**

4.2.7 Withdrawals

Actual number of withdrawals	12
Expected number of withdrawals	-
Average profit of leavers with benefits during the intervaluation period *(Formula 4.2.7.1)*	5,711
(Gain) / Loss *(Formula 4.2.7.2)*	**(68,526)**

4.2.8 Members who have left the scheme

Active Exits (G/L)	0
Deferred Exits (G/L)	0
Pensioner Exits (G/L)	(37,115)
Payments to Exits	0
(Gain) / Loss	**(37,115)**

4.2.9 Retirements

Liabilities in respect of New Retirees	621
Rolled forward Liabilities from last time for New Retirees	10,132
Lump Sum on Retirement	10,905
(Gain) / Loss on Liabilities *(Formula 4.2.9.1)*	**(9,511)**
(Loss) on Assets *(Formula 4.2.9.2)*	**(10,905)**

4.2.10 Change in benefit

There was no change in benefit during the inter-valuation period.

4.2.11 New entrants

The scheme is closed to new entrants.

4.2.12 Expected Benefit Outgo

Expected Benefit Outgo – liabilities *(Formula 4.2.12.2)*	(93,756)
Expected Benefit Outgo – assets *(Formula 4.2.12.1)*	(97,462)
Surplus / (Deficit)	**(3,707)**

4.2.13 Change in valuation assumptions

Value of liabilities on old basis	4,916,576
Value of liabilities on new basis	6,031,528
(Gain) / Loss	**1,114,952**

4.2.14 Other Items/Other Movements

In this case, we include the balancing as Other Item. The balancing item will be the sum of all liabilities explained before (€6,071,324) minus the actual liability (€6,031,528), resulting as (€39,796).

In the case of assets the calculation will be similar. The balancing item will be the sum of all liabilities explained before (€4,832,648) minus the actual asset (€4,838,410), resulting as (€5,762).